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selves as alleged; it only appears so to the outsider. Yet, it is necessary that our higher duties should be held up to view 'lest we forget.' Moreover, the time has come for the gathering of the new material unless we are to sink back into a shallow rumination of the old. The American biologist stands ready to expand his dominion into the old world, if he be given the means, and when he shall be through with his work, the facts and records will be in such a shape that the philosopher can rear a structure upon them that will stand.

The means by which he may be put in this enviable position have been set forth in another connection* and need not occupy us here.

LEONHARD STEJNEGER.

WASHINGTON, D. C.,

November 14, 1903.

SCIENTIFIC BOOKS.

The Positive Philosophy of Auguste Comte.

By L. LÉVY-BRUHL. Authorized translation, to which is prefixed an introduction by FREDERIC HARRISON. New York, G. P. Putnam's Sons. 1903. Pp. xiv + 363. 8°.

Anything that will help to make the philosophy of Auguste Comte known to the readers of English can not fail to be useful. The English translation, therefore, of a work on that subject by such a man as M. Lévy-Bruhl, the well-known author of the 'History of Modern Philosophy in France,' and who 'writes as a student and not an adherent of Comte,' is especially welcome.

It will probably be one day regarded as the most remarkable anomaly in the history of science that the work which formed the turning point from metaphysical to scientific philosophy—the 'Positive Philosophy' of Auguste Comte—remained three quarters of a century without being translated into the English language. This singular circumstance has led to some very peculiar results, and accounts for the totally false idea that the English-

* *Carnegie Inst. Yearbook*, No. 1, pp. 241-266, 'Plan for a Biological Survey of the Palearctic Region,' by Leonhard Stejneger and Gerrit S. Miller, Jr.

speaking world entertains with regard to Comte and his doctrines. Many suppose that he was a very bad, irreligious man. An eminent divine recently stated from the pulpit that 'Comte, the great French philosopher, taught that religion was only a phase of superstition that belonged to the childhood of the race and would be outgrown.' Interrogated as to where Comte taught this doctrine, he was unable to cite any work or passage. The fact is that Comte had a strong religious nature, and one of his aphorisms was that 'man is becoming more and more religious.'

Others, like Huxley (who does not seem to have read the 'Positive Philosophy'), see nothing of value in Comte's system. A common opinion is that it is a sort of utopia, and Comte's name is frequently associated with that of Fourier. Scarcely any one has the idea that he was a scientific man in the accepted sense of the expression, although he was by profession a mathematician.

The fact that Comte wrote another and later work, his 'Politique Positive,' in which he drew up a program of social regeneration and founded a cult, created the general impression that he was only a dreamer. His zealous followers from the standpoint of the cult saw to it that this work should be translated into English. There is no doubt that this did incalculable harm to Comte's entire system. For, in the first place, as M. Lévy-Bruhl clearly shows, it is impossible to understand the 'Politique Positive' without an acquaintance with the 'Philosophie Positive.' If Lévy-Bruhl had done nothing else than to dispel the illusion that the 'Politique Positive' was an after-thought, the product of a diseased mind, and a mere dream of a fanatic, it would have fully justified his writing this book. The few who have read the 'Philosophie Positive,' and especially those who have also read the five early papers written from 1819 to 1825, know already that the 'Politique Positive' was contemplated by Comte from the beginning, and was steadily kept in mind during all the patient years that it required to write the 'Philosophie Positive.' That work was to be simply the necessary preparation and scientific foundation for his final great con-

struction. How many edifices have crumbled whose foundations have stood the test of time! But the superstructure was built upon that foundation, and every line of the 'Politique Positive' must be read with the 'Philosophie Positive' in full view, otherwise it is utterly incomprehensible. It is small wonder, therefore, that the readers of the English translation of the former, called Comte's 'Positive Polity,' could make nothing of it, and set Comte down as a dreamer or something worse.

Another marked consequence of the failure to translate the 'Philosophie' has naturally been a systematic plagiarism of Comte's ideas. Persons of a certain type, and they are common enough, finding a great body of original ideas in a work almost completely unknown, have made it their opportunity to pass themselves off as profound thinkers. A learned professor in one of the leading universities once came by invitation and read a paper on the classification of the sciences before one of the scientific societies of Washington. It proved to be simply a summary of the Comtian hierarchy, but Comte's name was not mentioned and the views were put forth as original with the speaker. There was only one member present who detected the plagiarism and felt it his duty to expose it. I have collected a large number of similar cases, many of which are amusing.

As a third effect of the same cause may be mentioned the manner in which Comte's ideas have influenced English thought. Accessible only to the highest types of mind, they found themselves reflected only from such high sources, and as such men usually have systems of their own, they strive to conceal the extent to which they are influenced by others. This has been notably the case with Comte's influence. In this day it is easy to see that it was very great in England. John Stuart Mill and George Henry Lewes were the most frank in acknowledging it, but it is now clear that Carlyle, Buckle and many others were profoundly affected. That Herbert Spencer recognized Comte's value to the scientific world no one now doubts, notwithstanding his vigorous disclaimers of discipleship. No one has maintained that he was a disciple.

Indeed, the only disciples were those who accepted and strove to propagate his religion of humanity, and these usually cared very little for his scientific works; otherwise they would have had his 'Philosophie Positive' translated. That Spencer arranged his topics in substantially the Comtian order I have repeatedly shown,* but this does not imply discipleship, since it is the true order of nature. But Spencer could not have been ignorant of Comte's classification of the sciences. It had been before the world for thirty years before Spencer began the 'Synthetic Philosophy.' Others besides Mill had expounded it, and it was familiar to all the best minds. Spencer adopted both of Comte's new words 'sociology' and 'altruism,' and defended them with proper acknowledgments. Even his 'Social Statics' proved to be Comte's term, although Spencer thought it was Mill's. But his book by that name shows that he really had no idea of Comte's social statics or of social statics in any scientific sense.

Notwithstanding the handicap of a foreign language, Comte's fundamental doctrines have conquered the scientific mind, not only of England, but of the whole world. In conformity with the Scriptural saying, France was the last to recognize its own philosopher, but his day is now come. Streets are named for him, statues are erected to him, and his power has penetrated not only into academic but into legislative and administrative halls.

M. Lévy-Bruhl passes Comte's entire philosophy in review, but the treatment is somewhat uneven. The biological side is the least complete. It is true that Comte was not strong in biology, and accepted with certain reserves the doctrine of the fixity of species, as did nearly everybody in those pre-Darwinian days, but he was acquainted with Lamarck and believed in evolution and in the descent of man from an animal, even simian, ancestry. He worked out the doctrine of the interaction of the organism and the environment and carried it to a very advanced stage. He even foreshadowed the principle of natural selection, and it is remarkable that Lévy-Bruhl

* See SCIENCE, N. S. Vol. III., February 21, 1896, p. 294; 'Pure Sociology,' p. 69.

failed to point this out, especially as it had been pointed out by others, first in 1883 by the writer of this review,* and subsequently by Heinrich Waentig,† and also by his own countryman, M. Alfred Fouillée,‡ the passage being quoted in each case. It will bear quoting again. In the third volume of the 'Philosophie Positive,' which appeared in 1838, written, as he states in 1836, on page 392 he says:

If we conceive all possible organisms to be successively placed, during a suitable time, in all imaginable mediums, the greater part of these organisms would of necessity finally disappear and leave only those surviving which could satisfy the general laws of this fundamental equilibrium; it is probable that, after a succession of analogous eliminations, the biological harmony must have established itself little by little upon our planet, where we still see it continually modifying itself in a similar manner.

A scarcely less remarkable passage occurs in the fourth volume (p. 443), which appeared in 1839.

Lévy-Bruhl's treatment of Comte's psychology is much more satisfactory. It may seem strange that he should devote a chapter to psychology, when Comte expressly repudiated the word. But he gives a simple explanation of all this. In Comte's day psychology meant 'the science of the soul reached through the introspective method.' 'It was the science founded by Cousin on the analysis of the ego,' as taught by the eclectic school of philosophers. "Comte, who opposes these philosophers, did not wish his theory of psychical phenomena, which differed from theirs, to be called by the same name." He said in 1828: "Some men, not recognizing the present and irrevocable direction of the human mind, have endeavored for ten years to transplant German metaphysics into our midst, and to constitute, under the name of *psychology*, a so-called science entirely independent of physiology." Comte refused to regard psychic phenomena as distinct

from those of physiology, and, therefore, he included their study in biology, although he spoke of them as dealing with 'transcendental functions.' In fact, Comte thought that there might be a true science of *phrenology*, and tried to found that science, although, even in his day, as he himself knew and deplored, the process of prostituting that term had already begun, and soon after his death this had gone so far that the word, notwithstanding its perfect etymology and appropriateness, was wholly abandoned by scientific men, and the term psychology was resuscitated and adopted for the same science. But it is absurd to accuse Comte, as has been done, of lending any countenance to the vagaries of phrenology.

M. Lévy-Bruhl brings into clear relief the importance of sociology as a necessary part of Comte's scheme. When we remember that down to the year 1839 he had always called this science 'social physics,' first using this term in 1822, we can see very clearly what was in his mind. With him the characteristic of a true science was that its phenomena should conform to invariable laws. This he believed social phenomena to do. The name social physics was chosen to emphasize this view. It completed the series and supplied the final term that had always been lacking. 'We possess now,' he said, still at that early date, 'a celestial physics, a terrestrial physics, either mechanical or chemical, a vegetal physics and an animal physics; we still want one other and last one, social physics, in order that the system of knowledge of nature be complete.'

But he went farther and divided up the science on strict mechanical lines, founding both social statics and social dynamics. It would unduly extend this review to attempt to show how these two sciences were constituted, and the reader is referred to Lévy-Bruhl's fairly satisfactory presentation of the subject. But any mention of Comte's name almost requires the coupling of it with some reference to his celebrated law of the three stages (*trois états*) in the historical development of human thought, which constitutes the basis of his social dynamics. The attempt to maintain that this law was discovered and announced by Turgot, Condorcet, Burdin and

* 'Dynamic Sociology,' Vol. I., p. 119.

† 'Auguste Comte und seine Bedeutung für die Entwicklung der Socialwissenschaft,' Leipzig, 1894, p. 120.

‡ 'Le Mouvement Positiviste et la Conception Sociologique du Monde,' Paris, 1896, p. 101.

others is like ascribing the discovery of the principle of natural selection to Goethe, or Wells, or even to Comte himself, merely because in the writings of all these are to be found adumbrations of it. Comte it was who formulated the law and developed it at full length, devoting more than two volumes of the 'Positive Philosophy' to its elucidation, 'in all of which,' said John Stuart Mill, 'there is scarcely a sentence that does not add an idea.' Suffice it to say that it is a historical demonstration of the aphorism that ideas rule the world, and constitutes a complete philosophy of history based on the dictum of Leibnitz, that in all ages 'the present is full of the past and pregnant with the future.'

But this law has a still deeper significance, since whatever we may think of the theological and metaphysical stages of history, the positive stage is the age of scientific thought. The full characterization of this stage is the essence of the positive philosophy. As George Henry Lewes said, 'positive thinkers may be counted by thousands, but no one before Comte had a glimpse of the positive philosophy.' Now, to add sociology to the 'hierarchy' of the sciences was simply to complete the scheme of the 'Positive Philosophy.' Without it the scheme was truncated. But sociology was more than any of the other sciences. It was in a certain sense the science of the sciences, since it presupposed and embraced all the rest. An acquaintance with the others was necessary to it, because it was a synthesis of them all, and dealt besides with social phenomena, with which none of the others had anything to do.

So far as ethics is concerned, M. Lévy-Bruhl clearly shows that it is with Comte simply an aspect of sociology. Comte's ethics is not a moralizing, or a treatise on duty or on right and wrong, but a discussion of the origin of ethical ideas, growing out of the, as he claimed, spontaneous sociability of men—in a word, it is social ethics.

We need not follow our author farther and point out the 'positive transpositions,' or revaluations, that the positive philosophy has wrought in the ideas that prevailed before Comte's day. It is sufficient to have shown that M. Lévy-Bruhl has set him in a just light

before the world as a great organizing genius. His knowledge relatively to the time he lived was, like that of Spencer for his time, encyclopedic. Different as the systems of these two philosophers are, they each have practically the same relation to their respective dates and times. Comte was the philosopher of the first half, as Spencer was of the second half, of the nineteenth century. Comte's weight turned the scale in favor of the scientific method, and inaugurated a positive, which is the same as a scientific, *Weltanschauung*, destined to banish the hitherto prevailing theological and metaphysical conceptions of the universe. As Comte's works are more fully studied it is found that they constitute a vast storehouse of ideas. When a supposed new thought is put forth by some modern writer nothing is more common than to find that Comte had given clear expression to it more than half a century earlier. Much of the contemporary sociology consists in the rediscovery of the truths that Comte reached and fully set forth, and sociologists are just beginning to learn that they must go back to Comte as certainly as the metaphysicians must go back to Kant.

M. Lévy-Bruhl, in citing Comte's 'Philosophie Positive,' has used the fifth edition, 1892, which, unfortunately, is not uniform with all previous editions, and this makes the verification of passages somewhat difficult for those who can only consult the earlier and better known editions. The English translation bears the marks of 'business enterprise.' The short note by Mr. Frederic Harrison is magnified on the title-page into an 'introduction.' It is matter for regret that Mr. Harrison did not really contribute an introduction. On the other hand, the name of the translator, Kathleen de Beaumont-Klein, who contributes an excellent preface, does not appear on the title-page.

The translation is in the main good, but it is easy to find what are called 'gallicisms,' such as using the word *ignore* in the French sense of not to know, writing *movement* for *motion*, *experience* for *experiment*, *precious* for *valuable*, *conscience* for *consciousness*, etc. There certainly was no excuse in an English

translation for citing all German works by their French titles. LESTER F. WARD.

WASHINGTON, D. C.

Light Waves and Their Uses. By A. A. MICHELSON. Decennial Publications of the University of Chicago. Second Series, Volume III. University of Chicago Press, 1903.

The 'uses' with which this book is concerned are altogether those with which the author's name is so intimately associated; that is, the applications of interference methods whereby light waves are made the tools and units of measurements for physical and astronomical investigation. The Michelson form of interferometer, which has tremendously increased the applicability of this method, was invented as a means of attack upon one important problem which is here treated briefly—the well-known Michelson-Morley ether-drift experiment—still the subject of study, both experimental and theoretical.

An introductory chapter on wave motion and the general phenomena of interference serves to prepare the reader for the development of the interferometer principle, by which is meant the use of a plane reflecting and transmitting (glass) surface to split a beam of light into two, which are subsequently recombined, to produce interference fringes. The quantity directly measured is either a movement or shift of these fringes, or a change in their distinctness or 'visibility,' produced by changes in the relative retardation of the two beams between the points of separation and recombination. By this means changes in the relative retardation, which may in a particular case be produced by changes in position of a plane reflecting surface, can be measured with extreme accuracy. Again, the change in relative retardation may be produced by changes in the index of refraction of the medium through which one beam passes, or motion of the medium, or by the introduction of transparent films—and the corresponding shift of the fringes affords an exceedingly accurate means of measuring these changes.

Some of the many special cases in which this method has been applied are dealt with in

succeeding chapters; for example, the measurement of angles and distances, the study of spectrum lines and close groups of lines, the effect of a magnetic field on light-emission, the determination of the angular magnitude and 'structure' of stars, and the fundamental, but less fascinating, matter of the use of light waves as standards of length—*i. e.*, the evaluation of the meter in terms of the wavelengths of the red, green and blue radiations of cadmium.

The book is avowedly popular, being a reprint of Lowell Institute lectures, and the lecture style is retained throughout; nevertheless, it is to be feared that without the aid of experimental demonstrations, for which the good illustrations are hardly an equivalent, the 'general reader' would be rather overtaxed by some of the chapters. However, from the other standpoint of the preface, the book as a résumé in untechnical form, of important researches which have occupied Professor Michelson for the past twenty years, will be of great value, not only to scientists who have not read the original papers, but to many who have.

C. E. M.

Index to the Literature of the Spectroscope (1887 to 1900, both inclusive). By ALFRED TUCKERMAN. Smithsonian Miscellaneous Collections, 1902.

This index forms a continuation of a previous volume by the same author, which dealt with the literature up to 1887, and continues the subject up to the time when the work was taken over by the International Committee for Indexing Scientific Literature. The first half of the book is taken up with the author index, alphabetically arranged, of which the chief characteristics should be accuracy and completeness. Concerning the former a short examination suffices to detect a fairly large number of misprints, mostly trivial, besides a few cases of confusion of names, and one erroneous reference. Again, while absolute completeness is too much to ask for, there are omissions here which do not seem based on a fair estimate of the relative importance of various papers.

The second half of the volume contains the